REMARKS

Applicants appreciate the Examiner's thorough examination of the present application as evidenced by the Office Action of February 28, 2003 (hereinafter "Office Action"). In response, Applicants respectfully submit that the cited references fail to disclose, among other things, a liner layer that exhibits compressive stress characteristics and a contact plug that exhibits tensile stress characteristics that are in direct contact with each other. Accordingly, Applicants submit that all pending claims are in condition for allowance. Favorable reconsideration of all pending claims is respectfully requested for at least the reasons discussed hereafter.

Claim Objections

Claims 3 and 28 stand objected to because of the reference to an "amorphous crystal structure." In response, Applicants have amended Claim 3 to recite "an amorphous structure." Applicants are confused with regard to the objection to Claim 28 as this claim does not recite an "amorphous crystal structure."

Claims 4 - 6, 12, 14, and 32 Satisfy the Requirements of §112

Claim 4 stands rejected under 35 U.S.C. §112, ¶2 as being indefinite because the ohmic layer is described as being disposed between the liner layer and sidewalls of the insulating layer, but Claim 1 describes the liner layer as being disposed on sidewalls of the insulating layer. Applicants respectfully submit that Claim 4 is not indefinite. Applicants defined how the term "on" may be used in the present application at page 4 lines 9 - 13 as follows:

> It will also be understood that when an element, such as a layer, region, or substrate is referred to as being on another element, it can be directly on another element or intervening elements may be present. In contrast, when an element, such as a layer, region, or substrate is referred to as being directly on another element, there are no intervening elements present.

Thus, when interpreting Claim 4, the liner layer may still be considered as being "on"

sidewalls of the insulating layer even though the ohmic layer is an intervening element between the liner layer and the insulating layer. Accordingly, Applicants respectfully submit that Claim 4 and Claims 5 and 6 that depend therefrom satisfy the requirements of 35 U.S.C. §112, ¶2.

Claim 12 stands rejected under 35 U.S.C. §112, ¶2 as being indefinite due to a lack of antecedent basis for "the capacitor." In response, Applicants have amended Claim 12 to depend from Claim 11.

Claim 32 stands rejected under 35 U.S.C. §112, ¶2 as being indefinite due to a lack of antecedent basis for "the lower electrode of a capacitor." In response, Applicants have amended Claim 32 to recite "a lower electrode of a capacitor."

Claim 14 stands rejected under 35 U.S.C. §112, ¶2 as being indefinite because the recitation "another location" is unspecified. In response, Applicants have amended Claim 14 to recite "the gap is at another location." Thus, it should now be clear that Claim 14 is directed to the gap being wider at the surface of the insulating layer than the gap is at another location. That is, the gap is narrower at at least one location than it is at the surface of the insulating layer. Accordingly, Applicants respectfully submit that Claim 14 satisfies the requirements of 35 U.S.C. §112, ¶2.

Independent Claims 1 and 25 are Patentable

Independent Claim 1 stands rejected under 35 U.S.C. §102(b) as being anticipated by U. S. Patent No. 5,672,543 to Chang *et al.* (hereinafter "Chang"). Independent Claim 25 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Chang in view of U. S. Patent No. 6,404,058 to Taguwa (hereinafter "Taguwa").

Independent Claim 1 is directed to an integrated circuit device that comprises a liner layer and a contact plug, which are described as follows:

> ....
> a liner layer that exhibits compressive stress characteristics disposed on sidewalls of the insulating layer, which define the gap, and on the substrate in the gap; and

> a contact plug that exhibits tensile stress characteristics disposed directly on the liner layer. (Emphasis added.)

Similarly, Claim 25 is directed to a contact plug of a semiconductor device that comprises a TiN plug and a TiN liner, which are described as follows:

> a TiN plug having an upper surface contacting the upper conductive layer and having tensile stress;
> a TiN liner contacting the TiN plug so as to surround the TiN plug along the side wall and the bottom of the TiN plug and having compressive stress; and
> .... (Emphasis added.)

Thus, both Claims 1 and 25 recite that the plug and liner are directly on each other or are in contact with each other. The Specification explains that the direct contact of the liner, which exhibits compressive stress characteristics, may reduce the tensile stress exhibited by the plug. (Specification, page 7, lines 6 - 10).

In sharp contrast, the plug 28 shown, for example, in FIG. 8 of Chang is not directly on and does not contact the titanium nitride layer 26. Instead, Chang uses a cap stress buffer layer 42, which is disposed between the plug 28 and the titanium nitride layer 26. Moreover, Chang explains that "[t]he key feature of the present invention is the introduction of a stress buffer layer having tensile stress which effectively stops the volcano defects." (Chang, col. 3, lines 41 - 44). Applicants respectfully submit, therefore, that Chang teaches against placing a liner layer, which exhibits compressive stress, in direct contact with a plug, which exhibits tensile stress, but instead advocates placing a layer that also exhibits tensile stress between the plug and the liner layer. Applicants further submit that none of the other cited references provide the teachings missing from Chang.

Accordingly, for at least the foregoing reasons, Applicants respectfully submit that independent Claims 1 and 25 are patentable over the cited references and that Claims 2 - 14 and 26 - 32 are patentable at least per the patentability of independent Claims 1 and 25.

CONCLUSION

In light of the above amendments and remarks, Applicants respectfully submit that the above-entitled application is now in condition for allowance. Favorable reconsideration of this application, as amended, is respectfully requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (919) 854-1400.

It is not believed that an extension of time and/or additional fee(s)-including fees for net addition of claims-are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper may be charged to our Deposit Account No. 50-0220.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Mail Stop Non-Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on May 21, 2003.

Traci A. Brown